क्रमांक - 4798

ALLELOPATHIC EFFECT OF SOME INVASIVE SPECIES ON VEGETATION OF ARAVALLI HILLS OF AJMER DISTRICT OF RAJASTHAN (INDIA)

राजस्थान के अजमेर जिले की अरावली पहाडियों की वनस्पती पर कुछ आक्रामक जातियों का ऐलिलोपेथिक प्रभाव

A

Synopsis

Submitted for the registration for Doctor of Philosophy (Ph.D.)

To

Maharshi Dayanand Saraswati University, Ajmer (Rajasthan)

In the Faculty of Science (Botany)

(2016)

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APPENDIX - IV

MAHARSHI DAYANAND SARASWATI UNIVERSITY, AJMER

Format for Outline of Proposed Research work

1. Name of Scholar (In English) : **TRIPTI GUPTA**
   (In Hindi) : **तृप्ति गुप्ता**

2. Title of the Research Work :
(In English) : **ALLELOPATHIC EFFECT OF SOME INVASIVE SPECIES ON VEGETATION OF ARAVALLI HILLS OF AJMER DISTRICT OF RAJASTHAN (INDIA).**

(In Hindi) : "राजस्थान के अजमेर जिले की अरावली पहाडियों की वनस्पती पर कुछ आक्रामक जातियों का ऐलिलोपेथिक प्रभाव"

3. Location

a. Institution/Department where the work is to be done : **SAMRAT PRITHVIRAJ CHAUHAN GOVERNMENT COLLEGE, AJMER**

b. Geographical area of Investigation, if any. : **ARAVALLI HILLS OF AJMER DISTRICT**

4. Introduction Importance of Proposed Investigation, Objectives.
5. Review (Work already done on the subject of proposed Research Study.)
6. Research Gaps identified in the proposed field of investigation. (Based on the review)
7. Major Hypothesis, if any.
8. Research Methodology.
9. List of References cited.

Tgupta

Signature of the Candidate with date

Outline Approved.

Name and Signature of supervisor with date & seal.

Lecturer
Samrat Prithviraj Chauhan
Govt. College, Ajmer

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Appendix- IV

Name of Scholar: **Tripti Gupta**

Title of Research work: Allelopathic effect of some invasive species on vegetation of Aravalli hills of Ajmer district of Rajasthan (India)

Location: Department of Botany, Samrat Prithviraj Chauhan Government College, Ajmer

INTRODUCTION

The term allelopathy originated from Greek words allelon which means "of each other" and pathos which means "to suffer". Hans Molisch (1937) first outlined this concept and presented with the term allelopathy in his book Der Einfluss einer Pflanze auf die andere – Allelopathie. Allelopathy is a biological phenomenon by which a plant influences the seed germination, growth and physiological process of other plant through the production of one or more types of biochemicals. These biochemicals are known as allelochemicals and can have beneficial or adverse effects on the target plant and the community.

In nature plants grow together and compete with each other in both physically and chemically aspects. These competitions among plants categorise into two categories, (i) Plant competition and (ii) Allelopathy. Competition has been defined as an active struggle for same limited resources such as light, water, space and nutrients etc. Whereas Allelopathy is define as the effect of chemical interaction among the plants.

Almost every ecosystem has been amended with the plant and animal species. Plants of an ecosystem interacted with each other directly or indirectly, in the positive or negative prospect through the production of various kinds of chemicals. It can also define as chemical interaction between plants via several kind of biochemical except primary metabolites, effect the growth and development of another plant. This phenomenon is known as Allelopathy. It has been play a vital role in forests, composition of the vegetation growth, and also provides an explanation for the patterns of forest regeneration. Around 300BC Theophrastus noticed the inhibitory effect of pigweed on alfalfa. In 1964 Muller *et al* was firstly reported the zones of inhibition around some shrubs such as *Salvia leucophylla, Artemisia californica and Adenostoma fasciculatum* due to the releasing of some volatile chemicals by these shrubs.

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Allelochemicals are subset of secondary metabolites of plants, which do not have any common physiological target site or mode of action. However, known sites of action for some allelochemicals include suppression of growth and physiological activity of target plant by inhibition of cell division, germination, nutrient uptake, photosynthesis and specific enzyme function. Basically Allelochemicals are not required for any metabolic activity (i.e. growth, development, photosynthesis and reproduction) of the allelopathic organism. However allelochemicals with negative allelopathic potency are play an important part of plant defence mechanism against herbivory.

Plants produce allelochemicals can be present in any part of plant like root, stem, leaves, flower, fruit and seed. These allelochemicals release into the environment through various mechanism such as volatization, leaching, exudation and decomposition of plants residues. The production of allelochemicals is affected by various biotic and abiotic factors such as nutrients available, diversity, temperature and pH etc. Widely studied concept of allelopathy in forestry systems may affect many aspects of plant ecology, plant succession, structure of plant communities, growth, diversity of an ecosystem, dominance, occurrence and plant productivity. In Early researches, many of the forestry species evaluated with negative allelopathic effects on agroecosystem and crops, but later arround 1980s research was identified some species that have beneficial, neutral, or detrimental effects on companion plants.

Over many years, allelopathy has been reported in the literature with respect to plant interference in environment. Ancient literature has several evidences about the growth of crops which "rob the soil of nutrients". Plants exudates, which have allelopathic activity, are responsible for agriculture problems called soil sickness. The definition of allelopathy although broaden as considerable research has recently indicated the involvement of lower plants (algae, fungi etc) and microorganisms (bacteria, viruses etc) in the production of phytochemically active compounds (Inderjit and Weiner 2001; Putnam 1986; Rice 1984). John Harper (1977) was one ecologist who reported that, "Almost all species can, by appropriate digestion, extraction and concentration, be persuaded to yield a product that is toxic to one species or another."

The fundamental approach used in allelopathic research for agricultural crops has been to screen both crop plants and natural vegetation for their capacity to suppress weeds. To demonstrate allelopathy, plant origin, production, and identification of allelochemicals must be established as well as persistence in the environment over time in concentrations sufficient to affect plant species. In the laboratory based research, plant extracts and leachates are commonly screened for their effects on seed germination with further isolation and identification of allelochemicals from greenhouse tests and field soil, confirming laboratory results. Interactions among allelopathic plants, host crops, and other non-target organisms must also be taken into account. Furthermore, allelochemistry may provide basic structures or templates for developing new synthetic herbicides.

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Prosopis juliflora belongs to family Leguminosae and it is commonly known as vilayti babool, vilayti kikar etc. It is native to Central and South America, Mexico and Caribbean and an invader in India and in several other countries. Here it is found in arid and semi-arid regions. This is well-known in the folkloric system of medicine because of its ethnobotanical importance. It has been used as a folk remedy for catarrh, cold, diarrhea, dysentery, excrescences, flu, hoarseness, inflammation, measles, sore throat and in healing of wounds etc. The ground vegetation under its canopy indicates that it has some allelopathic potential which might have been caused either by fallen leaves or plant leachates or root exudates. Consequently, the release of allelochemicals into the soil inhibits seed germination and establishment of agricultural crops and vegetation.

Parthenium hysterophorus belongs to family Asteraceae and it is commonly known as congress grass or carrot grass. It is a native to North-East Mexico and endemic in America tropics. It is also use as traditional medicine for various diseases like neurologic disorders, malaria, dysentery etc and also has various ethnobotanicall and pharmacological uses. It also shows anti cancer and anti tumour properties. Manure compost from *Parthenium hysterophorus* has nitrogen, phosphorus and potassium (NPK) alone. This can be applied as organic manure. The plant produces various kinds of allelopathic chemicals that suppress crops, pasture plants and allergens that affect humans and livestocks. It is pollen grain inhibit fruit setting in tomato, beans, brinjal and number of other crop plants.

Allelopathy can be further defined as a mechanism of plant interference mediated by the addition of plant, produced secondary products into the environment. Biochemicals with allelopathic potential are present in almost all plants. In appropriate environmental conditions, these allelochemicals may be released into the environment in defined quantities to affect the growth and physiological activities of neighbouring plants.

STUDY AREA

The study will be carried out in the Aravalli hills of Ajmer district, Rajasthan. Rajasthan is the largest state of India, located in the north-western part of the nation. Geographically it lies between $23^0 30'$ to $30^0 12'$North latitude and $69^0 30'$ and $78^0 17'$ East longitude. The Aravalli range is the oldest range of folded mountains in the world, has an altitude of 100 to 350 m above sea level and Extending for about 692 km. from Gjuarat upto Delhi union territory through Rajasthan and Haryana states. It comprises approximately 550 km in Rajasthan.

The district Ajmer is divided into four subdivisions – Ajmer, Beawar, Kekri and Kishangrah and further subdivided into nine tehsils – Ajmer, Beawar, Bhinai, Sarwar, Sawar, Tantoli, Nasirabad, Masuda, Kekri and Kishanghar. The Ajmer is surrounded by the Aravalli hills. The city is side on the lower slopes of the Taragarh hill in the Aravalli Range. It is situated almost in the centre of Rajasthan. The selected area has high endemic

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plant diversity. The region also provides an interesting case study because of its topographic complexity, edaphic conditions and variability in climate.

IMPORTANCE OF PROPOSED RESEARCH WORK

Allelopathy is believed to be a new and promising discipline of science, although the acceptance of allelopathy is as old as civilization. This scientific field of research is full of striking outcomes and has already shared tremendous finding. However the chance of flourishing is still open in the mentioned area of research.

- The proposed research will reveal the vegetation Spectrum and may be helpful to assess the plant diversity and current states of vegetation of the Aravalli hills of Ajmer district.

- This research in the field of allelopathy will provide a significant contribution to adopt appropriate strategies, to manage invasive plants and weeds in natural and cultivated ecosystem.

- This research may screen the capacity of various crops and natural vegetation to suppress the growth and physiological activity of weeds, for the development of bioherbicides.

- The result of this investigation may be helpful to increase ecological & economic uses of *Prosopis juliflora* and *Parthenium hysterophorus.*

- Retrieved information from this research work will be helpful to maintain the biodiversity of cultivated and non cultivated ecosystems.

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OBJECTIVES

- Exploration of the knowledge leading to the beneficial role of Allelopathy in conservation of the plant species.
- Insight on the contributing factors to improve the biodiversity of the studied region.
- Investigation of the possibilities of using allelochemicals as growth regulators and natural herbicides, to promote sustainable agriculture.
- Enlightening the lacuna to meet the information gaps about the nature and inter-relationship of the vegetational constituents.
- Elucidation of the specific uses of allelochemicals involved in the weed suppression.
- Presentation of the natural vegetation and species which are endangered and are in process of extinction.
- Investigation to know about the economic value of *Prosopis juliflora* and *Parthenium hysterophorus*.

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REVIEW OF LITERATURE

Allelopathy refers the direct or indirect effect of one plant to another through the production of phytotoxic chemicals, which escape into the environment. The term allelopathy first introduces by a Plant Physiologist Prof. Hans Molischin (1937) in his book Der Enifluss einer pflanze auf die andere – Allelopathie. He used this term to describe the phenomenon of both the injurious and advantageous biochemical interaction among plants. Thereafter in worldwide numerous allelopathic researches had been carrying out in various fields of biological science, natural and agricultural ecosystems.

International allelopathy society (IAS) (1996), Refers allelopathy as "Any process involving secondary metabolites produced by plants, fungi, algae, bacteria and viruses that influence the development and growth of agriculture and biological system." The concept of allelopathy got attention again (1974), after the publication of the book on Allelopathy by Elroy L. Rice. Rice (1984), define allelopathy as the effect of one plant as a donor on the another plant as a recipient through the production of some chemical compounds into the environment. It includes both beneficial and harmful effects.

Various ecologists like Muller *et al* (1970), Duke *et al* (1987), Callaway *et al* (2000), Awasthi *et al.* (2008), Blum (1996) and Legrand *et al* (2003), etc supports the concept of suppression or negative effect on growth and physiological functions of one plant species by another plants through the production of some compounds known as allelochemicals into the surrounding environment. Kholi *et al* (1998) and Singh *et al* (2002), propound that allelopathy refers to direct or indirect effect of one plant to another neighbouring plants through the release of various kinds of chemical substances and plays a vital role in various agro ecosystems.

He H.B., Wang H.B. and Fang C.X. *et al* (2012), suggest for sustainability of agriculture, use of allelopathic strategies of weed management, is a alternative weed management strategy to minimize or eliminate the use of artificial pesticides(herbicides, insecticides, fungicides etc) to control pests or weeds. The use of artificial pesticides to control pests has caused several serious issues such as environment contamination or pollution, drawn many hazardous effect on health of human and livestock and development of resistance in organisms.

Narwal (2003) and Inderjit (2005) define Allelopathy will provide the best alternative solution, to get rid from the problems like invasion and encroachment of weeds in cropland and forest ecosystem. Bhadoria (2011) Allelopathic potential of certain plants can be use as an alternative weed management strategy to reduce weed up to a certain

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extent, for improve crop production, maintain forest ecosystem and also it is beneficial for environment.

Kulshreshtha M. and Gopal B. (1983) worked on allelopathic properties of Hydrilla on the species of Certophyllum and noticed the inhibitory effect on their growth. Ahire Y.R., Souwalkar R.P.and Deokule S.S. (2012) reported *Lagenaria siceraria* roots, stem, leafs have negative allelopathic effect is respectively increases towards the *Phaseolus aconiti* seed germination and seedling growth.

Kaur R., Wilfredo L., Callaway M., Inderjit (2012) accounted the harmful effect of invasive species *Prosopis juliflora* on the biodiversity of the area and *Prosopis cineraria* leafs litter drag a harmful impact on the physiological activity and increase the mortality rate of *Dalbergia sissoo*. Kumar S. and Mathur M. (2014) studied the impact of Invasive Species *Prosopis juliflora* on native plant communities of arid grazing lands and conclude the density of an endangered species *Commiphora wightii* decreased with increasing density of *Prosopis juliflora*.

Mohammad AL. Tawaha A.R. (2010) has highlighted allelopathic properties of *Sorghum bicolor* L. and *Zea mays* L. As a herbicide against the seed germination and growth of wild barley. Pukclai P. And Kato-noguchi H. (2013) accounted the allelopathic activity of *Amonum krevanh* to suppress the growth of weeds and suggest to use, it for the development of bioherbicide for weed management.

Gnanavel I. (2013) reported the rapid spreading of invasive weed *Parthenium*, would be a greater risk for natural and agro ecosystem of India. He also reported the chemical substance produce by *Parthenium* often induce severe dermatitis and allergic symptoms in human. Sharma K.P. (1985) accounted the allelopathic effect of algae on the growth of *Eichhornia crassipes*. Algae secret some substances which inhibits the growth of *E. crassipes* by reducing the level of chlorophyll a and b content and the rate of vegetative propagation.

Saxena K.M. (2013) proposed to use the terrestrial weed *Lantana camara* to control the aquatic weed water hyacinth cause of its highest degree of toxicity towards water hyacinth. Sharma S.K. *et al* (2011) found the highest allelopathic potential in the leaf of *Lantana camara* L. in comparison of its root and stem against the regeneration of *Pogonatum aloides* in culture media. Gedenas (2001) reported highest degree of phytotoxicity in the leaf extract of *Lantana Camara* as compaire to stem and root, due to the presence of complex interactions between its all allelochemicals.

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Kumar S. (2015) accounted *Abutilon indicum* L. shows positive allelopathic effect and promote the seedling growth of barley whereas *Parthenium hysterophorus* L. Suppressed the seed germination and seedling growth of barley indicates the inhibitory potential of *P. hysterophorus* L.

Gupta A. And Mittal C. (2012) studied allelopathic effects of various weeds found in Ajmer district on *Triticum aestivum* L. and found the variation in the degree of suppression with the change in concentration of different weed extracts. They reported *Phalaris minor* leaf extract has more negative impact on the seed germination and seedling growth of *Triticum aestivum* L.

Gupta P. (2016) reported beneficial and detrimental effect of some medicinal plants leaf effects on the seed germination and seedling growth of mung bean. Chaves and Escudero (2001) accounted that allelopathic effect of a plant may reduce both population size and number of other plant species. An *et al* (2005) Suggested Applelopathy is involved in successful invasions and plants which release the allelochemicals are known as aggressive coloniser.

Singh S. (2012) revealed the presence of various kinds of phytochemicals such as tannins, flavonoids, alkaloids, phenolics, terpenes and steroids etc in most parts of *Prosopis juliflora* and also suggests ethanol and water to be the best solvent in extracting metabolites from *Prosopis juliflora*. Ibrahim M. *et al* (2013) also reported *Prosopis juliflora* is a rich source of natural constituents especially for flavonoids, alkaloids and saponins.

Several researchers like Joshi *et al* (1981), Ghayal *et al* (2007), Ansari *et al* (1983), Hoque *et al* (2003), Bras *et al* (2001), Batish *et al* (2001), Kong *et al* (2004), Devaranavadgi *et al* (2004), Mara *et al* (2005), Al-Wakeel *et al* (2007) and Li *et al* (2009) have given importance to identification of allelochemicals which are the secondary metabolites existing in their leachates, extracts and residues. They have characterized allelochemicals in different groups like terpenoids, flavonoids, phenolic compounds and essential oils existing in many invasive and native plant species.

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RESEARCH GAP

The term Research Gap reflects the possibilities and scope area for the new researches and investigations in the proposed filed. As we go through the earlier studies and identifying the research lacuna, on the allelopathic activities of some invasive species on various types of plants in Aravalli hills of Ajmer district.

Allelopathy refers to the beneficial or detrimental effects of one plant on another plant, both crop and weed species, from the release of biochemicals, known as allelochemicals, from plant parts by leaching, volatilization, root exudation, residue decomposition, and other processes in both natural and agricultural systems. Allelochemicals are a subset of secondary metabolites not required for metabolism (growth and development) of the allelopathic organism. Allelochemicals with negative allelopathic effects are an important part of plant defense against herbivory (Fraenkel 1959: Stamp 2003).

The fundamental approach used in allelopathic research for agricultural crops has been to screen both crop plants and natural vegetation for their capacity to suppress weeds. To demonstrate allelopathy, plant origin, production, and identification of allelochemicals must be established as well as persistence in the environment over time in concentrations sufficient to affect plant species. In the laboratory based research, plant extracts and leachates are commonly screened for their effects on seed germination with further isolation and identification of allelochemicals from greenhouse tests and field soil, confirming laboratory results. Interactions among allelopathic plants, host crops, and other non-target organisms must also be taken into account. Furthermore, allelochemistry may provide basic structures or templates for developing new synthetic herbicides. Studies have elucidated specific allelochemicals involved in weed suppression, including benzoxanoids in rye: diterpenoid momilactones in rice: tabanone in cogongrass: alkaloids and flavonoids in fescue: anthratectone and naphthotectone in teak (*Tectona grandis*): abscisic acid beta-d-glucopyranosyl ester in red pine: cyanamide in hairy vetch: and a cyclopropene fatty acid in hazel sterculia (*Sterculia foetida*).

But still there is a lacuna in the field of Allelopathic effects of some invasive species on vegetation of the Aravalli hills of Ajmer district. Aravalli has vast spectrum of flora and fauna due to the hilly track, is a treasure trove of the biodiversity.

The result of proposed research may be helpful to meet the information gaps about the nature and interrelationship of the vegetation of the Aravalli hills of Ajmer district.

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MAJOR HYPOTHESIS

Having understood the earlier studies and identifying the research lacuna on the allelopathic activities of *Prosopis juliflora* and *Parthenium hysterophorus* on various types of plants, I have set forward following hypothesis to pursue my research work.

- Invader species *Prosopis juliflora* and *Parthenium hysterophorus* predominant in environment at the expenses of native species possess strong allelopathic activity.
- Abiotic and biotic factors govern the allelopathic activity of the plants.

As a result, allelopathy might be taken into account as a pivotal contributing factor for the biodiversity richness through this hypothetical statement of allelopathy.

RESEARCH METHODOLOGY

The plant materials use in this study will be collected from the Aravalli hills of Ajmer district, Rajasthan. The best way to study allelopathic effect of *Prosopis juliflora* and *Parthenium hysterophorus* is to find out signs of it occurring in nature. It is impossible to see the toxin at work, but it is possible to see the signs and symptoms caused by the allelochemicals on surrounding plants. For example very few plants grow with *Prosopis juliflora* and *Parthenium hysterophorus* and those that grow, often times look sick and chlorotic. This is a sign of the allelotoxin. Along with recognizing the signs of allelopathy, ability of identification of plants must.

Collection of Plant materials

For the study of allelopathy effect plant materials of *Prosopis juliflora* and *Parthenium hysterophorus* will collect from different localities of Aravalli hills of Ajmer district, Rajasthan. The collected plants material will bring to laboratory and wash to remove dust particles and other contaminate. Root, stem, leafs, flowers and fruits will detach and the fully mature fruit will keep separately at laboratory for collection of seeds. The collected fresh parts of the plant material will dried in oven having exhaust fan at 60^0C till constant weight obtain. (Martin *et al*, 1987). The dried plant parts will powder separately and stored in polythene bags for preparation of extracts. The seeds of the target species will collect from agriculture shop and forest department, Ajmer.

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Testing for Allelopathy in the laboratory

The laboratory setting is the perfect place to test the susceptibility of plants to allelopathy effect. The effect of allelopathy on sensitive plants can easily be tested in the lab and green house settings. While the testing, seeds that do not germinate in the presence of allelochemicals are probably show toxicity effect of allelochemicals and plants which become chlorotic and eventually die in the presence of allelochemicals, showing signs of toxicity.

a) Preparation of Extracts

Plant sample was extracted with the help of various organic solvents (hexane, chloroform, acetone and ethanol) in the order of their increasing polarity and finally with distilled water. 500 grams of dry powder will take in beaker and hexane will be added to it so that the plant material gets totally immersed in the solvent. This whole setup will keep for 48 hours with frequent shaking. It will first filter with a muslin cloth, then with whatman filter paper (No.1) finally centrifuge at 5000 rpm for 5 mins. Whole process will be repeated 3 times and supernatant will collect and pool together. Plant material leave after filtration will air dry to evaporate the hexane completely and then will immerse with chloroform. It will extract 3 times with chloroform. The above process will be applied with acetone, ethanol and water and there supernatant will collect. Extracts will be concentrated to $1/20^{th}$ of their initial volume with the help of rotary evaporator (Buchi Rotavapor R-200/205) at 40 °C under different pressure conditions for the solvent. All the extracts will keep in air tight bottle at 4°C.

b) Phytochemicals screening

i. **Test for Saponins:** Boiled 300 mg of extract with 5 ml water for two minutes. Mixture will cooled and mixed vigorously and leave it for three minutes. The formation of frothing indicates the presence of saponins.

ii. **Test for Tannins:** To an aliquot of the extract will be added in sodium chloride to make to 2% strength. Filter and mix with 1% gelatin solution. Precipitation indicates the presence of tannins.

iii. **Test for Phenolic compounds:** Formation of intense green, purple, blue or black colours with addition of 1% ferric chloride solution to the extract.

iv. **Test for Triterpenes:** 300 mg of extract will mix with 5 ml chloroform and warm for 30 minutes. The chloroform solution is then treated with a small volume of concentrated sulphuric acid and mixed properly. The appearance of red colour indicates the presence of triterpenes.

v. **Test for steroids:** 200mg plant material will be taken in 10 ml chloroform and then filtered. In 2ml filtrate, 2ml acetic anhydride and small amount of

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H_2SO_4 will be added, appearance of blue green ring indicates presence of steroids.

vi. **Test for alkaloids:** 200mg plant extract will dissolve in 10ml methanol and then filter. In 1ml filtrate 6 drops of Dragondroff's reagent will add. Appearance of orange precipitate indicates presence of alkaloids.

vii. **Test for flavonoides:** 5ml of dilute ammonia solution will be added to the filtrate followed by concentrated sulphuric acid. If yellow colour observes indicates the presence of flavonoides.

viii. Test for **cardiac glycoside:** Keller-Kiliani test: 5ml of extract will be treated with 1ml of glacial acetic acid containing 1 drop of ferric chloride solution .This will be underplayed with 1ml of concentrated sulphuric acid. Appearance of brown ring of the interface indicates the presence of deoxysugar characteristic of cardenolides.

c) Germination bioassay

The seeds of the target species will place in Petri dishes lined with sheets of filter papers moistened with different plant extracts or distilled water. Petri dishes containing target species seeds will maintained in a biochemical oxygen demand germination chamber at suitable temperature. After preliminary tests performed to determine the optimal germination conditions for each target species, all of the Petri dishes will maintained on a 12 hr light and 12 hr dark period cycle. Germination counts will be made every 12 hr for 15 days. Seeds that sprouted a 2 mm plumule will be classified as having germinated.

d) Seedling growth bioassay

The seeds will be used in this bioassay, first germinated in water (until presenting a plumule length of 2-4 mm), then moved to transparent plastic boxes or Petri dishes, lined with sheets of filter paper and moistened with different plants extracts or distilled water. The boxes or Petri dishes will be kept in biochemical oxygen demand germination chambers at suitable temperature and maintained 12 hr light and 12 hr dark period cycle. The length of the shoot and primary roots in mm will be measured after seven days.

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CHAPTERISATION

1. Introduction
2. Review of Literature
3. Materials and Methods
4. Physiography of Aravalli hills of Ajmer district
5. Phytochemical screening of *Prosopis juliflora* and *Parthenium hysterophorus*
6. Allelopathic effect *Prosopis juliflora* and *Parthenium hysterophorus* on growth of Aravalli hill vegetation
7. Allelopathic effect on Diversity of Aravalli hill
8. Discussion and summary
9. Literature cited

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